Electrochemical Investigation and FEM Modeling of Ion- and Water-Transport through Polymer Membranes

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Intended and unintended ion transport through polymer membranes comprising many fields of research, for example in medical applications (dialysis) or energy storage (PEMFC) and corrosion protective coatings. To improve the properties of anticorrosion coating, like paints and polymer films, it is important to understand the transport mechanisms and to make them measurable for comparison.

This work presents a method to measure the transport of ions through imide coatings, which have wide use as protective layers in microelectronics. The presented method uses a diffusion cell, consisting of two small chambers, filled with aqueous electrolyte, separated by a freestanding membrane from the polymer of interest and uses electrochemical techniques to measure the ion transport. Additionally, a FEM model is fitted to the acquired measurement to extract the properties and to validate assumed transport mechanisms. To support the simulation, ion concentration profiles through the membranes are determined by LA-ICP-MS measurements.